Pathology of Aging Psittacines

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KEYWORDS

• Psittacines • Geriatric • Atherosclerosis • Lung fibrosis
• Neoplasia • Cataract • Chronic liver disease

Aging is the accumulation of progressive cellular changes typically associated with decreased physiologic function. These changes result in generalized impairment of physiologic functions, a decreased ability to respond to stresses, an increased risk of age-associated disease, and an increased likelihood of death. This phenomenon is universal to all living things, although life span and life expectancy differ among species and even among individual members of a species.

Birds are prone to many of the same diseases that afflict aging mammals, including waning fertility, cardiovascular disease, cancers, cataracts, and osteoarthritis. Although few studies or reviews have examined the process of aging in our personable and relatively long-lived parrots, generally they appear to have aging rates that are much slower than those for similar-sized mammals.[1–4]

PHYSIOLOGY

Surprisingly, birds, bats, and a few other organisms with high metabolic rates have some of the slowest rates of senescence.[5] In general, birds live long and age slowly, despite their high metabolic rates (1.5–2.5 times higher than similar-sized mammals) and very high total lifetime energy expenditures, which may be five or more times higher that those of mammals.[1,6–8]

Birds seem to have evolved specific adaptations for combating oxidative and glycoxydative processes thought to be the primary causes of aging-related cellular damage.[1,9–16]

Current theories of senescence suggest that wear and tear at the cellular level (oxidative and glycoxydative stress and telomere shortening or other genetic damage) result in damage that cannot be repaired.[17–21] An extended life span is expected in individuals with large amounts of antioxidants, as such antioxidants prevent free

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radical–induced cell injury and facilitate repair.[5,22,23] The effect of telomere length is less well associated with cellular senescence. Telomeres are conserved nucleotide sequences essential for replication by ensuring complete replication of chromosomal ends and protecting the chromosomal termini from fusion and degradation. Chromosomal telomeres have been shown to shorten with age in somatic cells of humans, and are implicated in cellular senescence in mice.[24–26] One study has found avian telomeric DNA sequences (from 18 species and subspecies of birds in several different orders) to be five- to 10-fold longer than in mammals.[27] Two studies found telomere length was not reliably correlated with aging rates or life spans in birds.[24,28] However, other works have reported a positive correlation between age-related changes in telomere lengths in several bird species with markedly different life spans.[29–31]

OVERVIEW

This article includes a summary of disease conditions in older psittacines submitted to a private exotic species pathology service, Zoo/Exotic Pathology Service (ZEPS) in West Sacramento, California (**Table 1**). This is not meant to represent a true prevalence of the disease in this population, as there will be a bias due to decisions (perceived value of the information to the practitioner or client) in submitting cases for pathologic examination. The population chosen includes commonly kept species having adequate numbers of submissions. Small birds, such as budgerigars (*Melopsittacus undulatus)* and lovebirds (*Agapornis* sp) were considered elderly at 6 years; cockatiels (*Nymphycus hollandicus*) at 12 years; and large psittacines, such as Amazon parrots (*Amazona* sp), macaws (*Ara* sp), cockatoos (*Cacatua* sp), and African grey parrots (*Psittacus erithacus*), at 30 years. These are somewhat arbitrary assignments but based on life-span reports in the literature.[32,33] Lesions were tabulated. However, not all submissions had a complete set of tissues to examine and many birds had multiple lesions considered to be age-related. In summary, some of the typical changes seen in aging mammals (eg, chronic interstitial nephritis) are not so often seen in birds (**Fig. 1**). However, some disease problems are seen more often in older birds than in younger ones.

DISEASES BY ORGAN SYSTEM

Cardiovascular Disease

A number of aging changes to the heart are well recognized in mammals, especially humans. These include increasing epicardial fat, hypertrophic changes to the left ventricle associated with hypertension, calcification of the valves, a loss of myocytes, an increase in collagenized connective tissue, and the accumulation of intracytoplasmic lipofuscin. Cardiac disease has been historically underdiagnosed in pet birds. However, with increasing use of radiography, electrocardiography, and echocardiography, cardiac disease has been found to occur more often than previously assumed.[34]

The two disease conditions best described in the aging psittacine heart include atherosclerosis and lipofuscin accumulation.

Atherosclerosis

Atherosclerosis is reported most often in Amazon parrots, particularly the blue-fronted Amazon parrot (*Amazona aestiva aestiva*); African grey parrots; and macaws. Atherosclerosis also occurs sporadically in a variety of species (**Fig. 2**). Afflicted birds can be of any age, but most are 8 or more years old and many are more than 15 years old.[35,36] In one report, the incidence of atherosclerosis in the examined parrots was 91.9% in African grey parrots and 91.4% in Amazon parrots.[37] In birds older than 19 years, no unchanged vessels could be seen. The youngest bird with this alteration was 6 months

Table 1
Summary of disease conditions in older psittacines submitted to a private exotic species pathology service, ZEPS

Species	Total Number	Age Range	Average in the Range	Tumors	Chronic Liver Disease	Inflammatory Skin Lesions	Heart Lesions[a]	Gonadal Degeneration	Chronic Kidney Disease	Systemic Inflammation	Pneumoconiosis	Xanthoma
Budgerigar	229	6–15 y	7.8 y	153 (66.8%)	13 (5.7%)	8 (3.5%)	7 (3%)	10 (4.4%)	2 (0.9%)	18 (7.9%)	7 (3%)	5 (2.2%)
Lovebird	206	6–18 y	9.1 y	71 (34.4%)	21 (10%)	47 (22.8%)	23 (11.2%)	11 (5.3%)	0	18 (8.7%)	2 (1%)	5 (2.4%)
Amazon	168	30–86 y	38.2 y	59 (35%)	14 (8%)	10 (5.9%)	15 (8.9%)	5 (3%)	0	41 (24.4%)	15 (8.9%) (1 pulmonary fibrosis)	9 (5.3%)
Cockatiel	383	12–30 y	15.5 y	190 (49.6%)	40 (10%)	30 (7.8%)	33 (8.6%)	9 (2.3%)	22 (5.7%)	21 (5.5%)	9 (2.3%)	20 (5.2%)
Macaw	66	30–60 y	35 y	25 (37.8%)	5 (7.5%)	4 (6%)	10 (15%)	0	2 (3%)	14 (21.2%)	15 (22.7%)	2 (3%)
Cockatoo	27	30–45 y	34 y	8 (29.6%)	1 (3.7%)	3 (11%)	2 (7.4%)	0	1 (3.7%)	8 (29.6%)	0	1 (3.7%)
African grey	41	30–53 y	33 y	14 (34%)	3 (7.3%)	1 (2.4%)	8 (19.5%)	0	1 (2.4%)	8 (19.5%)	4 (9.7%)	0

[a] Heart lesions include artherosclerosis and/or lipofuscinosis.

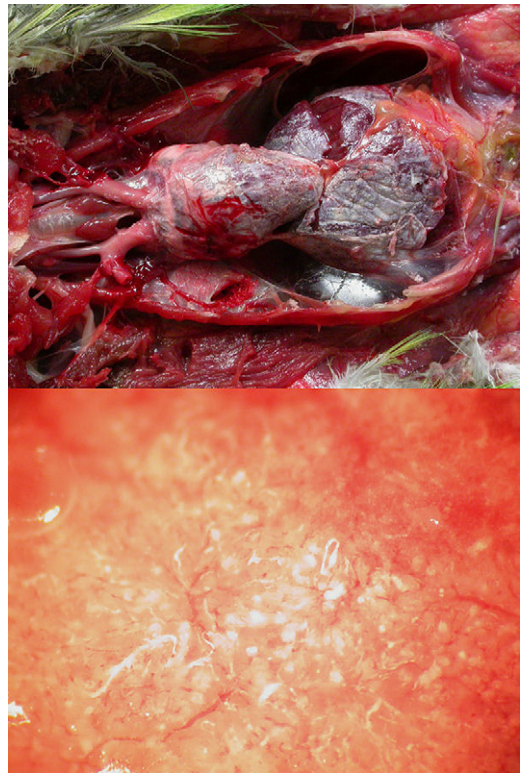

Fig. 1. (*Top*) Visceral gout associated with a chronic interstitial nephritis in a 31-year-old double yellow-headed Amazon (*Amazona oratrix magna*). (*Bottom*) In the close-up of the kidney, many uric acid tophi are visible.

old. The most affected groups with stage 2 to 4 lesions were the age groups with birds older than 26 years. One survey identified the average age as 12 years.[38]

The plaques can be found in the aorta, the brachiocephalic trunks, and the pectoral and carotid arteries. Coronary artery involvement is rare. Grossly, the arterial wall is

Fig. 2. Severe atherosclerosis of the larger arteries in a 25-year-old sulphur-crested cockatoo (*Cacatua galerita*).

variably thickened with roughened yellow intimal plaques. Histologically, atherosclerosis is characterized by vacuolated smooth muscle cells and macrophages (foam cells that contain cytoplasmic cholesterol and cholesterol esters) within the intimal layer of aorta and large arteries (**Fig. 3**). In addition, there can be microhemorrhage, chondroid metaplasia, fibrosis, and mineralization.[36,37] Commonly these lesions cause increased arterial resistance that affects the heart. Early changes in the heart include hypertrophy of the left ventricle followed by left ventricular dilation, dilation of the left atria, right heart dilation, and right heart failure. Right heart failure can lead to congestion, atrophy, and, subsequently, cirrhosis of the liver (**Fig. 4**). With these chronic changes, the birds may present with loss of body condition, although many die unexpectedly and are in excellent condition or even obese.

Many birds die because of a decreased blood supply to the brain as a result of severe narrowing of the carotid arteries. There may be a history of the bird going through periods of a loss of awareness of their surroundings in the days or weeks before their death.

Atherosclerosis can also lead to aneurysmal dilation of the arteries. It is rare to see ischemic disease of the heart.

Many risk factors have been postulated; increased age (adults) and a history of being fed a diet rich in fat are strongly associated with the condition.[36,38,39]

Lipofuscin

Another age-related lesion of the heart is the progressive accumulation of the cytoplasmic pigment lipofuscin. Lipofuscin is an intralysosomal pigment associated with excessive oxidation and polymerization of unsaturated fatty acids. It may accumulate in cells, including cardiac myocytes, secondary to a variety of disease processes, although it is usually associated with emaciation, chronic disease, or aging. It is usually considered an incidental necropsy finding. If severe, the myocardium may have a brown discoloration. Microscopically, fine yellow-brown pigment is seen, primarily near the cell nucleus, but more diffuse within the cytoplasm in severe cases.

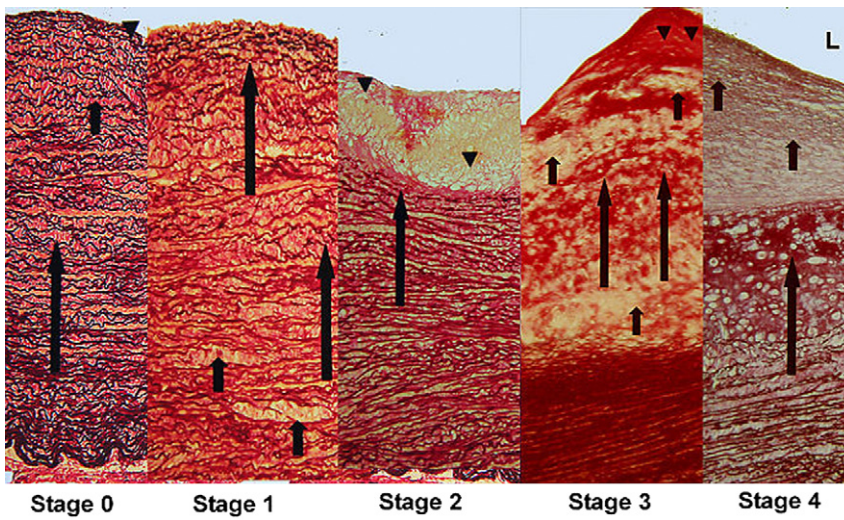

Fig. 3. Histologic staging of atherosclerosis in the arteria brachiocephalica (elastica Weigert van Gieson staining). Arrowheads indicate intima. Large arrows indicate elastic fibers. Small arrows indicate interstitial matrix. L, lumen.

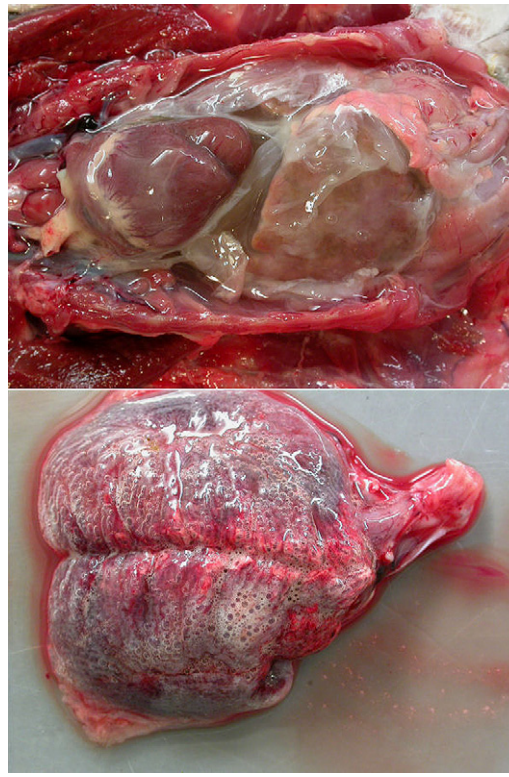

Fig. 4. Liver cirrhosis (*above*) and severe lung edema (*below*) in a 51-year-old African grey parrot (*P erithacus*).

From the ZEPS survey of commonly submitted psittacines examined, the species with the greatest percentage of cardiac lesions, including atherosclerosis or lipofuscinosis, were African grey parrots (see **Table 1**). Although only 41 birds were examined, 19.5%[8] of these birds had cardiac lesions. The next most common species with chronic heart lesions were macaws with 15% when examining 66 birds. Lovebirds surprisingly also had a significant amount of atherosclerosis and lipofuscinosis: Of 206 birds, 23 (11%) had cardiac lesions. Amazons, cockatiels, and cockatoos were identified with these lesions at 7% to 8.9% of the group. Only 3% of budgerigars, 7 out of 229, had heart lesions.

Integument

Aging changes in the skin of mammals (dogs and cats) are reported as a loss of elasticity, decreased pH, decreased hydration, decreased transepidermal water loss, and decreased skin-fold thickness.[40–42] Most studies in birds are of aging alterations of muscle and fat in the skin of commercially important food species (ie, geese, ducks, and poultry).[43–45]

One study in a group of aging macaws clinically noted degenerative changes of muscle wasting, weight loss, and decline in feather condition most prominent in birds over 40 years of age. The facial skin developed pigmented spots, polyps, and wartlike

blemishes with cysts and wrinkling. Thinning of the skin was clinically evident on the face and feet of birds over 40 years of age.[46]

It could be postulated that increasing stiffness of joints and damage to the beak would affect feather grooming and subsequently the appearance of the feather coat (**Fig. 5**). However, no studies or reports are found that have identified such changes.

After cutaneous tumors, the most common primary skin lesion noted in the ZEPS survey of the lesions in aging psittacines was dermatitis. A number of the lesions seen were associated with a history of self-trauma, and an underlying cause was not always recognized (see **Table 1**). Lovebirds over the age of 6 had a significant percentage (22.8%) of inflammatory skin lesions. These primarily were the nonspecific syndrome of lovebird dermatitis, or chronic ulcerative dermatitis. The affected area was usually the patagium or neck and back, and apparent pruritis leads to self-mutilation. A viral cause has been suggested but has yet to be identified.[47] Only six of the inflammatory skin lesions were consistent with the syndrome polyfolliculitis. This is another skin lesion of which the cause is still unknown. Both of these syndromes are chronic and often recur.[47]

Liver

Chronic liver disease is the result of repeated injury to the liver over a lifetime. Unfortunately, by the time it has become an end-stage liver (cirrhosis/fibrosis), the identity of the injury can no longer be determined. The potential causes are numerous and can include toxicities (therapeutic agents or naturally occurring toxins); chronic cholangitis or obstructive biliary disease; chronic congestion from right-sided heart failure; disorders of metabolism, such as iron storage disease or hepatic lipidosis; and chronic hepatitis. These are the common insults for mammals and are also expected to be seen in birds.

The lesions of hepatic fibrosis, bile duct reduplication, and aggregates of granulocytic extramedullary hematopoiesis are the typical findings in chronic liver disease in birds.[48] Amazon parrots, cockatiels, macaws, and budgerigars seem to be more

Fig. 5. Unkempt feathers in a 45-year-old African grey parrot (*P erithacus*). This bird had degenerative lesions of the joints in the wings and feet on physical examination and radiographically.

commonly recognized with chronic liver disease (**Fig. 6**).[49] Some cases also support inflammation of the liver and are described as chronic active hepatitis.

The cause of the changes is generally unknown. Cockatiels are reported to be sensitive to aflatoxins and it has been speculated that chronic active hepatitis in these birds may result from a previous exposure to aflatoxins.[49] Chlamydophila infections and exposure to bile-excreted toxins, such as Doxycycline, could also be potential causes.[49]

Grossly, the affected livers are variably shrunken, pale, and fibrotic. The capsule is often thickened and the edges of the liver are rounded (**Fig. 7**). In extreme cases, there may only be small firm nodules in place of the normal liver. Perihepatic effusion is common. The histologic appearance varies with the stage of the disease.[49]

A review of cases from the ZEPS survey found chronic liver disease in 7.5% to 10% of older lovebirds, Amazons, cockatiels, macaws, and African grey parrots. Budgerigars and cockatoos had the lowest percentage: 5.7% for budgerigars and 3.7% for cockatoos.

Musculoskeletal System

Degenerative lesions of the joints are not uncommon in older psittacine birds. Causes include previous trauma or infection, or metabolic conditions, such as gout. Grossly affected joints are enlarged, and there may be cartilagenous erosions. Cartilagenous flaps and free cartilage may be found in the joint cavity. Eventually, osteophytes and fibrosis form in the joint capsule and periarticular soft tissue.[50]

Degenerative changes of muscle wasting and joint stiffness were reported in a group of aging macaws and were most prominent birds over 40 years of age. Joint stiffness was characterized by a limitation in the range of motion of the joints, particularly the hock (intertarsal) joints. There were also twisting deformities that developed at the carpi, causing the primary flight feathers to twist laterally.[46]

Villonodular synovitis is a rarely described lesion of older cockatiels (Drury R. Reavill, DVM, PhD, personal observations). It appears as an inflammatory and proliferative process of the joint synovium. Until recently, these proliferative lesions were described as idiopathic and possibly immune mediated. They are now considered to be neoplastic.[51]

Reproductive System

Reproductive aging has been studied extensively in domestic species (poultry and quail). Generally, there is a decline in fertility and reproductive behavior. Gonadal function changes lead to the cessation of the ovulatory cycle and declining spermatogenesis. At the neuroendocrine level, age-related alterations affect the function of the gonadotropin-releasing hormone system.[52]

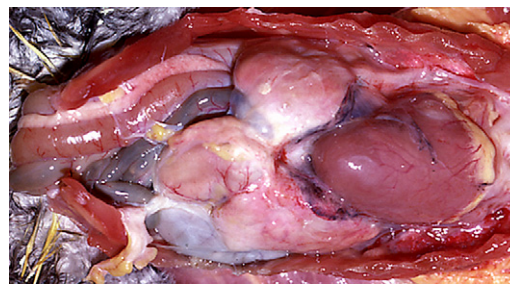

Fig. 6. Chronic liver disease in an Amazon parrot.

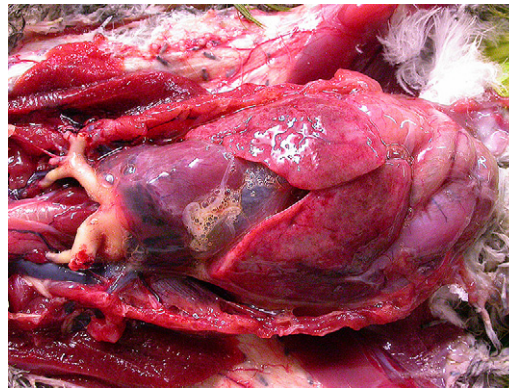

Fig. 7. Liver fibrosis in a 49-year-old Panama Amazon (*Amazona ochrocephala panamensis*).

There is one report on the reproductive life span of one group of free-flight breeding macaws (Parrot Jungle & Gardens, Homestead, FL, USA). The oldest birds to successfully breed were 35 years old. It was noted that the average age for raising the first chicks was 13.5 years. The most productive years were from the late teens to the early twenties. In this group of birds, the reproductive activity declined in the twenties to thirties.[53]

Budgerigars and canaries (*Serinus canaria*) have reproductive life spans up to five times longer than comparatively sized mammals, such as rats and mice (4-5 years vs 1–2 years). In captivity under hospitable conditions, birds generally enjoy postreproductive life spans of one third or more of the total life span.[3]

Due to the seasonal variation in the size of the avian testis and presence or absence of spermatogenesis, changes in size of the testes or an absence of spermatogenesis must be carefully interpreted. Atrophy can be the end result of a degenerative process, and has been associated with generalized malnutrition, particularly vitamin E deficiency.[54]

Ovarian tumors are better reported in psittacines than are degenerative changes. In general, the ovary will support fewer primary ovarian follicles and these are usually small, degenerating structures (follicular atresia).

Examined cases from ZEPS identified gonadal degeneration evident in 4.4% of elderly budgerigars, 5.3% of lovebirds, 2.3% of cockatiels, and 3% of Amazon parrots (see **Table 1**).

Respiratory System

The effects of aging on the respiratory system in mammals are similar to those that occur in other organs: Maximum function gradually declines. Age-related changes in the lungs include decreases in the peak airflow, gas exchange, and vital capacity (the maximum amount of air that can be breathed out following a maximum inhalation); weakening of the respiratory muscles; and a decline in the effectiveness of lung defense mechanisms. In aging psittacines, problems found in the respiratory system are mostly related to repeated insults (and resulting inflammatory responses), such as inhalation of dusts, irritating gasses, and microorganisms, including viruses, bacteria, and fungal spores. These repeated ‘‘injuries’’ eventually lead to chronic scar tissue (fibrosis) and granulomatous changes. Also, circulatory and cardiac problems lead to (transient) interstitial edema that causes repeated minimal fibrotic reactions. The most commonly seen pathologic changes are chronic pulmonary interstitial fibrosis

and focal granulomas with accumulation of dust-laden macrophages (pneumoconiosis or anthrasilicosis).

Chronic pulmonary interstitial fibrosis

Chronic pulmonary interstitial fibrosis has been more frequently described in the European population of older psittacines, although it is also been seen in the United States in a number of psittacines (Drury R. Reavill, DVM, PhD, personal observations). This syndrome was described in older Amazon parrots and is characterized as a chronic respiratory disease resulting in exercise intolerance. Pathologic examination revealed loss of functional lung tissue, pulmonary interstitial fibrosis, and right heart failure. Hematology revealed an elevated packed cell volume as a result of an increase in erythrocyte size and an increased hemoglobin mass per erythrocyte. In two patients, hypoxia and hypercapnia were demonstrated.[55] The cause of this syndrome was not identified but it was suggested that toxic substances, bacterial and chemical toxins, allergy, or viral infections could play a role in the pathogenesis of chronic pulmonary interstitial fibrosis in birds. In live birds, a computed tomography of the complete bird showed generalized lung alterations consistent with lung fibrosis. After taking lung biopsies, the tentative computed tomography diagnosis of pulmonary interstitial fibrosis was confirmed.[56]

Pneumoconiosis

Pneumoconiosis (anthrasilicosis) is the focal accumulation of dust-laden macrophages in the interatrial septa of the tertiary bronchi. These lesions generally suggest exposure to airborne pollutants and appear incidental in sedentary pet birds. The lungs may have macroscopic miliary black foci, although usually the accumulations are not observed grossly. The histiocytic aggregates are located subtending the mucosa of the epithelium of the air sacs, infundibula, and atria of tertiary bronchi, and around vessels. The histiocytes have intracytoplasmic granular black pigments and refractile pale yellow crystalline material, which is birefringent with polarized light. There may be infiltrates of lymphocytes and plasma cells associated with the nodules. When the crystalline material has been examined by transmission electron microscopy and x-ray spectra, most of the crystals are silicates. The silicates do not appear to elicit fibrosis in birds.[57]

SPECIAL SENSES

Cataracts are common lesions described in older animals. Acquired cataracts have been associated with nutritional deficiencies, trauma, toxins, infection and inflammation of the eye, and aging. Many older psittacine birds have cataracts and falcons appear to have a higher incidence than many other birds. Cataracts are opacities of the lens secondary to altered lens metabolism, usually following some injury to lens epithelium or capsule (epithelial basement membrane). Cataracts can be classified according to age of onset or location within the lens. Morphologically the usual structure of the capsule and lens fibers is altered.

Grossly, cataracts present as lens opacities. Histologic early changes may be limited to swelling of lens fibers with bladder cell formation. There may be epithelial hyperplasia as well as foci of capsular thinning. With progression, cystoid spaces can develop and lens protein will coagulate and fibers fragment. Mature cataracts involve the entire lens. Hypermature cataracts develop when necrotic cortical material is lost, leading to a small lens with a wrinkled capsule.[58,59]

In a group of aging macaws with ophthalmic disorders, cataracts were the most common problem. These would initially present as an opaque striation in the lens

cortex. Birds with rapidly developing cataracts often progressed to phacolytic uveitis and, if left untreated, became blind.[46]

Nervous System

Degenerative aging changes of the central nervous system are best characterized in humans. Few articles cover degenerative lesions in the avian brain. These include studies about song-learning of various species, amyloid plaques in a woodpecker, and atherosclerosis in quail.[60–62] Specifically in psittacines, lipofuscin, atherosclerosis, and Lafora bodies have been described.[63–65]

Lipofuscin is a common finding in the neural cell bodies of older parrots. Generally, the lesion is mild, but in some birds the accumulation can be prominent. It is suspected that in most cases this pigment accumulation does not have a functional significance.[66]

Atherosclerosis of the carotid arteries and even involvement of the cerebral arteries may result in cerebral ischemia and hypertension.[64]

Lafora bodies may not necessarily be lesions of aging. One investigator (Drury R. Reavill, DVM, PhD, personal observations) has identified it only rarely (blue-headed pionus [*Pionus menstruus*], blue-fronted Amazon, cockatiel) and all have been adult birds. Clinically, it is characterized by tremors, ataxia, or seizures. Lafora disease is characterized by periodic acid-Schiff–positive polyglycosan inclusions (Lafora bodies) found in neurons and muscle. Polyglycosan differs from normal glycogen in being short-chained, densely packed, insoluble, and heavily phosphorylated.[65]

Oncology

Age has an important influence on the likelihood of tumor development. This is due to an increase in genetic damage from the action of environmental agents and errors in repair. Few studies have reviewed numerous tumors and their biologic features, including the age of the birds at diagnosis (**Fig. 8**).

Air sac carcinomas

Air sac carcinomas are rare tumors and it is often difficult to definitively identify the air sac as the tissue of origin. The few cases described have been in mature, large psittacines (cockatoo, African grey parrot, macaw, Amazon parrot).[63,67,68] Cases were initially presented with cystic masses or bony lesions primarily involving the humerus.

Fig. 8. Cystic ovary tumor in a 28-year-old Moluccan cockatoo (*Cacatua moluccensis*).

Hemangiomas and hemangiosarcomas

Hemangiomas are benign tumors of vascular endothelium. They are reported more commonly in budgerigars than in other birds and usually occur in the skin (feet, inguinal region, cloaca, side of neck, wing) and spleen. The average age of occurrence is 10.8 years (range 3–20 years).[69]

Hemangiosarcoma is the malignant form of hemangioma, also known as malignant hemangioendothelioma or angiosarcoma. The beak, wings, feet, legs, and cloaca are the most common sites for cutaneous hemangiosarcomas. Cockatiels lead the list of affected species, which also include chickens (*Gallus gallus domesticus*), swans (*Cygnus* sp), Amazon parrots, lovebirds, African grey parrots, pionus parrots, budgerigars, parakeets, canaries, and finches. Hemangiosarcomas are locally invasive and multicentric. Skin tumors tend to appear inflamed and necrotic. The affected age range is similar to that of hemangiomas and the sexes are evenly represented.[70]

Hemangiolipomas, benign tumors of adipose tissue and blood vessels, are uncommon tumors that originate in the subcutaneous tissue on the body or limbs. Affected species include a budgerigar, a yellow-collared macaw (*Primolius auricollis*), a cockatiel, a lovebird, a blue-fronted Amazon, and a canary. All affected birds were more than 9 years of age.[70]

Myelolipomas, uncommon tumors, are well-delineated, expansile, benign extramarrow neoplasms composed of varying proportions of fat and hematopoietic cells. They are considered choristomatous (histologically normal tissue in an abnormal location) hematopoietic stem cell elements. According to the literature, the majority occur on the wings (some bilaterally) of adult (7–20 years old) female cockatiels. In lovebirds, myelolipomas occur as multiple masses in the subcutaneous tissues of the body and wing.[70–72]

Reproductive tumors

Seminomas, tumors of immature germ cells, grossly appear yellow-red and cause enlargement of the testis. Anorexia, lethargy, and dyspnea were the most common clinical signs reported. The average age at diagnosis was 9.2 years from one study.[73]

Sertoli cell tumors are primary testicular tumors of gonadal-stroma that arise from the Sertoli (sustentacular) cells. Sertoli cell tumors are generally firm, gray-white neoplasms that appear nodular on section. The common clinical signs reported included anorexia, dyspnea, cardiac changes (bradycardia, murmur) and, in budgerigars, a color change of the cere from blue to brown. The average age at diagnosis was 10.2 years in one study.[73]

Xanthomas

Xanthomas are not true neoplasms, but they are locally invasive and are usually identified in older psittacines. The average age of affected birds is 10 years (range 3–30 years). These are masses of foamy macrophages, multinucleated giant cells, and cholesterol clefts that produce thickened, dimpled skin with yellow to orange coloration and occur infrequently in internal organs.[69]

A review of case submissions of older psittacines to ZEPS identified older budgerigars as having an increased number of tumors (66.7%). Tumors on cockatiels were identified in about half of the cases. Tumors in the other species—lovebirds, Amazons, macaws, cockatoos, and African greys—comprised about one third of the case submissions.

SUMMARY

Aging processes leading to specific organ problems are not obvious in aging psittacines. In general, birds live long and age slowly, despite their high metabolic rates and very high total lifetime energy expenditures. Most pathologic processes seen in older parrots are generally not specific for aging because they are seen in young birds as well. Pathologic processes that have a tendency to occur more in older psittacines are atherosclerosis and repeated injury processes, such as chronic pulmonary interstitial fibrosis, pneumoconiosis, liver fibrosis, and lens cataracts. Also some neoplasms are more often seen at an older age.

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